

What is claimed is:

1. A void-fill system for automatically determining and supplying an amount of dunnage material sufficient to fill the void left in a container in which one or more objects have been placed, comprising:
  - a dunnage dispenser which is operable to dispense a controlled amount of a dunnage material;
  - a container scanner having a scan area, the container scanner including a height sensor for sensing a height characteristic of a container, a width sensor for sensing a width characteristic of the container, and a contour sensor for sensing a contour characteristic of the one or more objects in the container; and
  - a logic device that is operable to
    - process sensed characteristic information received from the height sensor, width sensor and contour sensor;
    - determine the amount of dunnage material needed to fill the void left in the container not occupied by the one or more objects; and
    - command the dunnage dispenser to dispense the determined amount of dunnage material.
2. A void-fill system as set forth in claim 1, further comprising a conveyor for conveying the container through the scan area.
3. A void-fill system as set forth in claim 2, wherein the logic device calculates a length characteristic of the container as a function of the sensed characteristic information received from at least one of the sensors and the rate at which the conveyor conveys the container through the scan area.
4. A void-fill system as set forth in claim 2, wherein the contour sensor continuously senses the top surface of the one or more objects in the container as the container is moved through the scan area by the conveyor.

5. A void-fill system as set forth in claim 1, wherein the width sensor senses the distance a side of the container is spaced from a reference point.

6. A void-fill system as set forth in claim 1, wherein the width sensor  
5 is an infrared distance sensor.

7. A void-fill system as set forth in claim 1, wherein the contour sensor is an optic laser scanner.

10 8. A void-fill system as set forth in claim 1, wherein the height sensor includes an emitter array of emitters and a receiver array of receivers disposed on opposite transverse sides of the scan area.

9. A void-fill system as set forth in claim 8, further comprising a  
15 container conveyor for conveying the container through the scan area; and wherein the container scanner includes a frame having a pair of uprights straddling the container conveyor and a cross beam supported atop the uprights at a fixed distance from the container conveyor, and wherein the emitter and receiver arrays are respectively mounted to the uprights, and the contour sensor  
20 is mounted to the cross beam.

10. A void-fill system as set forth in claim 2, further comprising a stop gate associated with the container conveyor for controllably permitting passage of containers into the scan area.

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11. A void-fill system as set forth in claim 1, further comprising a selector device connected to the logic device for enabling the selection of a void-fill density from a plurality of void-fill densities, and wherein the logic device, in response to a selected void-fill density, varies the amount of dunnage material to  
30 be dispensed per measured volume of void, thereby to provide the selected void-fill density.

12. A void-fill system for automatically determining and producing an amount of dunnage material sufficient to fill the void left in a container in which one or more objects have been placed, comprising:

5 a dunnage dispenser which is operable to dispense a controlled amount of a dunnage material;

a void-measuring apparatus which measures the amount of void left in a container after one or more objects have been placed in the container, the void-measuring apparatus being operative to command the dunnage dispenser to dispense a prescribed amount of dunnage material; and

10 an input device connected to the void-measuring apparatus which enables selection of a void-fill density from a plurality of void-fill densities, and wherein the void-measuring apparatus, in response to a selected void-fill density, varies the amount of dunnage material that the dunnage dispenser is commanded to dispense per measured volume of void, thereby to obtain the  
15 selected void-fill density.

13. A void-fill system as set forth in claim 12, wherein the void-measuring apparatus includes

20 a container scanner having a scan area, the container scanner including a height sensor for sensing a height characteristic of a container, a width sensor for sensing a width characteristic of the container, and a contour sensor for sensing a contour characteristic of the one or more objects in the container; and

a logic device that is operable to  
25 process sensed characteristic information received from the height sensor, width sensor and contour sensor;

determine the amount of dunnage material needed to fill the void left in the container not occupied by the one or more objects based on the selected void-fill density; and

30 command the dunnage dispenser to dispense the determined amount of dunnage material.

14. An apparatus for automatically determining an amount of dunnage material sufficient to fill the void left in a container in which one or more objects have been placed, comprising:

a logic device; and

5 an input device connected to the logic device which enables selection of a void-fill density from a plurality of void-fill densities; and

wherein the logic device is operable to

process sensed characteristic information of a container in which one or more objects have been placed;

10 determine the amount of dunnage material needed to fill the void left in the container not occupied by the one or more objects based on the selected void-fill density; and

command a dunnage dispenser to dispense the determined amount of dunnage material.

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15. An apparatus for automatically determining an amount of dunnage material sufficient to fill the void left in a container in which one or more objects have been placed, comprising:

20 a container scanner having a scan area, the container scanner including a height sensor for sensing a height characteristic of a container, a width sensor for sensing a width characteristic of the container, and a contour sensor for sensing a contour characteristic of the one or more objects in the container; and

a logic device that is operable to

25 process sensed characteristic information received from the height sensor, width sensor and contour sensor;

determine the amount of dunnage material needed to fill the void left in the container not occupied by the one or more objects; and

command a dunnage dispenser to dispense the determined amount of dunnage material.

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